ORIGINAL ARTICLE

Effect of Lidocaine 2% on Bacterial Culture of Bronchial Fluid

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ABSTRACT

Objective: To evaluate the action of 2% lidocaine on the culture results of bronchial fluid in patients suspected of having lower respiratory tract infections.

Study Design: Cross-sectional analytical study.

Place and Duration of Study: Shahid Sadoughi Hospital, Yazd, Iran, from November 2014 to November 2015.

Methodology: Patients suspected of lower respiratory tract infections referred to bronchoscopy unit of the Hospital were included. Those with incomplete questionnaire and bronchoscopy contraindication were excluded. Bronchial fluid was aspirated before and after local application of 2% lidocaine and cultured, according to the suspected clinical diagnosis. Finally, statistical analysis was performed using SPSS software, version 17.0. For statistical comparisons, McNemar's test was used. Level of significance was kept at $p \leq 0.05$.

Results: The mean age of the study population was 51.83 ±15.93 with a range of 25 - 80 years. Out of 130 patients, 60 patients had positive culture results. Nineteen (31.7%) cases had positive culture for tuberculosis and 41 (63.3%) cases had positive results for other bacteria before intervention that did not change after using 2% lidocaine (p=1). In 70 (53.84%) cases, results were negative before and after use of 2% lidocaine.

Conclusion: No significant difference was found between culture results before and after the use of lidocaine. Therefore, lidocaine can be used during bronchoscopy to increase patient tolerance.

Key Words: *Respiratory infection. Tuberculosis. Bronchial fluid culture. Lidocaine. Bronchoscopy.*

INTRODUCTION

Since the introduction of cocaine in 1884, local anesthetic agents have been used as a mainstay of pain management.[1] Because lidocaine has a rapid onset with e few complications, it is commonly used for injection at a 2% concentration. At higher concentrations, it can be used as a topical local anesthetic agent. Besides pain relieving effect, antimicrobial effects of several local anesthetic agents have been reported.[2-4]

Some anesthetic agents have an antibacterial impact, such as bupivacaine, mepivacaine and lidocaine.[5-9] Bronchoscopy is a very beneficial method for obtaining specimen for culture of many bacterial and fungal organisms commonly causing pulmonary infections.[10,11] In most centers, the anesthetic effect of lidocaine is used on the vocal cord and proximal portion of the trachea to decrease the gag reflex and patient irritability during bronchoscopy.[12,13] Lidocaine is present in many bronchoscopic specimens,[14] however, it may reduce the diagnostic yield of bronchoscopy by supressing the growth of pathogens in the cultural fluid.[15]

The primary mechanisem of the antibacterial effect of local anesthetics, particularly lidocaine, is not yet obviously investigated.[16,17] The physican should be aware of the false-negative result , that would happen due to the antimicrobial activity of the anesthetic agents.[7]

The purpose of this study was to evaluate the efficacy of 2% lidocaine on bacterial growth in bronchial fluid.

METHODOLOGY

In this cross-sectional analytical study, 130 patients suspected with lower respiratory tract infections were entered who were referred to bronchoscopy unit of Shahid Sadoughi Hospital, Yazd, Iran, from November 2014 to November 2015. Inclusion criteria were patients admitted to bronchoscopy unit of Shahid Sadoughi Hospital with a presumptive diagnosis of infectious diseases such as tuberculosis and bronchiectasis fit for bronchoscopy. Exclusion criteria were incomplete questionnaire and bronchoscopy contraindication,

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Received: December 01, 2016; Accepted: November 06, 2017.

including recent myocardial infarction, uncontrolled heart failure, significant decrease or increase in blood pressure, asthma or severe chronic lung diseases, severe hypoxia, life-threatening arrhythmias and lack of informed consent. The Ethics Committee of the Faculty of Medical Sciences approved the study.

Initially, all patients received 5 to 7.5 mg of midazolam, and then bronchoscopy was performed. In the first stage, bronchoscopy was carried out without local anesthesia, and bronchial fluid secretions were lavaged after injection of 75 ml normal saline, and then used for smearing and culturing of acid-fast bacilli, bacteria or fungal infections based on the presumptive diagnosis and clinical suspicion.

Next the bronchoscope was gotten back to the throat area and then 5 ml 2% lidocaine was used to provide local anesthesia in the supraglottic region, vocal cords and the proximal part of trachea (total volume: 15 ml), and then 75 ml normal saline 0.9% was injected; finally, bronchial fluid was lavaged and then used for smearing and culturing of acid-fast bacilli, bacteria or fungal infections based on the presumptive diagnosis and clinical suspicion. The lavaged fluids were sent in separate containers to the microbiology unit of Shahid Sadoughi Hospital and Nikoopour Clinic.

Statistical analysis was performed using Statistical Package for the Social Sciences 17.0 (SPSS Inc., Chicago, IL, USA). Samples results in terms of positive culture for *Mycobatrium tuberculosis* and other organisms before and after the intervention were presented in frequencies with percentages. Age (mean ±SD) and gender were reported. For statistical comparisons, McNemar's test was used because the data was nominal and paired. Level of significance was kept at p 0.05.

Table I: Comparison of samples results in terms of tuberculosis before and after the intervention.

Culture results of tuberculosis before intervention	Culture results of tuberculosis after intervention		Total
	Negative	Positive	
Negative	41 (68.3%)	0	41 (68.3%)
Positive	0	19 (31.7%)	19 (31.7%)
Total	41 (68.3%)	19 (31.7%)	60 (100 %)

P-value = 1.0; N = Number; % = Percent

RESULTS

Out of the 130 patients, 60 patients had positive culture results for tuberculosis, other bacterial infections and fungal infections. The mean age of the study population was 51.83 ±15.93 years with a range of 25 - 80 years. Of the 60 patients who had a positive culture, 31 (51.7%) were females and 29 (48.3%) were males. In 58 (96.7%) cases, clinical suspicion was tuberculosis, in 48 (80%) cases clinical suspicion was related to other bacteria, and in 10 (16.7%), fungal infections were suspected. The radiology results showed that 19 patients (31.7%) had diffuse bronchiectasis, four (6.7%) had local bronchiectasis, and three each (5%) had left lung involvement and (5%) bilateral upper lobes infiltration.

Nineteen (31.7%) cases had positive culture results of tuberculosis before intervention that did not change after the intervention (Table I). Therefore, 2% xylocaine had no effect on bronchial fluid culture results related to tuberculosis (p-value = 1).

Culture results obtained from samples related to bacteria before and after the intervention were compared (Table II). In 38 (63.33%) cases, culture result before the intervention was positive and none of these cases changed after the intervention.

In 22 (36.7%) cases, bacterial culture results were negative before the intervention, and after the intervention did not change.

Culture results obtained from samples related to fungal infections before and after the intervention were also

Table II: Comparison of samples results in terms of bacteria before and after the intervention.

Results		Bacteria culture results after the intervention						
Bacteria culture results before the intervention		Negative	*Pseudomonas*	*Klebsiella*	*Streptococcus*	*Acinetobacter*	Others	Total
Negative	N	22	-	-	-	-	-	22
	%	36.7	-	-	-	-	-	36.7
Pseudomonas	N	-	12	-	-	-	-	12
	%	-	20	-	-	-	-	20
Klebsiella	N	-	-	6	-	-	-	6
	%	-	-	10	-	-	-	10
Streptococcus	N	-	-	-	12	-	-	12
	%	-	-	-	20	-	-	20
Acinetobacter	N	-	-	-	-	1	-	1
	%	-	-	-	-	1.7	-	1.7
Others	N	-	-	-	-	-	7	7
	%	-	-	-	-	-	11.6	11.6
Total	N	22	12	6	12	1	7	60
	%	36.7	20	10	20	1.7	11.6	100

P-value = 1.0; N = Number; % = Percent

compared using McNemar's test. In 6 (10%) cases culture results before the intervention were the *Candida* and in 3 (5%) was *Mucormycosis*. In 51 (85%) cases, culture results before the intervention were negative. None of these cases changed after the intervention.

DISCUSSION

Anesthetic agents, such as lidocaine, not only use for decreasing pain, as well as have antimicrobial activity also.[1,5-7]

The results of a multiple *in vitro* and *in vivo* studies over the past years have demonstrated an additional role of local anesthetics in prevention of infections. In 1976, James, *et al*. assessed the effect of bupivacaine on bacterial growth, in addition to the incidence of contamination of catheters and syringes used during epidural analgesia.[18] Bupivacaine (0.25%) proved bactericidal to both *S. epidermidis* and *Corynebacterium* spp. at 37°C, but not at room temperature.

Further evidence of the antimicrobial effect of local anesthetics was presented by Rosenberg, *et al*.[19] This study showed that high clinical concentrations (0.25%) of bupivacaine inhibited the growth of multiple organisms; hence, they were suggesting a protective effect against bacterial and fungal infections for some of local anesthetic agents.

Hodson, *et al*. compared the antibacterial activity of the isomers bupivacaine and levobupivacaine against *S. epidermidis, S. aureus* and *E. faecalis*, and found the minimum bactericidal concentration of bupivacaine to be lower than that of levobupivacaine (0.25% vs 0.5%, respectively).[20] Racemic bupivacaine, therefore, appears to have more potent antimicrobial activity than its isomer levobupivacaine.

In addition to evaluation of the antimicrobial capacity of local anesthetics, Sakuragi, *et al*. studied the rate of onset of bacterial growth inhibition.[21] Bupivacaine (0.125%, 0.25%, and 0.5%), mepivacaine (2.0%), lidocaine (2.0%), and lidocaine (2.0%) with preservatives were each tested with two strains of methicillin-resistant *S. aureus* (MRSA) for 1, 3, 6, 12, and 24-h at room temperature and cultured subsequently on agar. They found greater exposure time corresponding to lower colony counts. In a follow-up study, Sakuragi, *et al*. examined the bactericidal activity of preservative-free bupivacaine for two strains of MRSA and *E. coli*.[22] The pathogens were exposed to the bupivacaine for 1, 3, 6, 12, and 24-h at 37°C and room temperature. The results showed that increasing concentrations of bupivacaine and temperatures from room temperature to 37°C correlated with lower colony counts.

The antifungal activity of benzydamine, lidocaine, and bupivacaine against 20 *Candida* strains were evaluated by Pina-Vaz, *et al*.[17] The antifungal activity progressed from fungistatic at lower concentrations, secondary to yeast metabolic impairment, to fungicidal at higher concentrations, secondary to cytoplasmic membrane damage, as evidenced by staining.

Noda, *et al*. did quantitative analysis of the antibacterial activity of local anesthetic agents by measuring their minimum inhibitory concentration (MIC), killing curves, and post-antibiotic effect (PAE). Colonies of bacteria such as *S.aureus*, were utilized as a part of the examination. At standard clinical concentrations, both bupivacaine and lidocaine had antibacterial effect.[23]

Aydin, *et al*. analyzed the antimicrobial effect of some local anesthetic agents on several pathogens, such as *E. coli*. Of the four agents tested, lidocaine and prilocaine had the most strong antimicrobial activity. Inhibiting growth of all pathogens tested at different anesthetic concentrations of 2% and 1%, prilocaine inhibited the growth of *E. coli, S. aureus* and *P. aeruginosa*, whereas 1% lidocaine inhibited only *P. aeruginosa*.[24]

An examination was done to survey the antibacterial impacts of alkalinized liclocaine on three bacteria including *Staphylococcus (S.) aureus, Escherichia (E.) coli*, and *Pseudomonas (P.) aeruginosa*. Compared with the control, lidocaine significantly inhibited the growth of these three organisms at baseline and 3 and 6 hours after incubation (all, $p < 0.05$). The antibacterial impact of lidocaine 1% on *S. aureus* was not altered after alkalinization. The impact of lidocaine as alkalinized on *E. coli* and *P. aeruginosa* was significant only at six hours.[25]

In present study, no significant difference was found between culture results before and after the use of lidocaine.

The present study differed from the above mentioned studies in examination of human models instead being *in vitro*, comparison before and after the intervention, and the adequate sample size. It seems that the reasons of no impact of lidocaine on bacterial culture were dilution by saliva, suctioning secretions by bronchoscope, absorption of lidocaine by oral mucosa, and airways and short contact time of lidocaine with secretions before culture.

CONCLUSION

According to the results of this study and comparison with other similar studies, lidocaine 2% 15cc can be used locally to reduce the gag reflex during broncho-scopy and increase patient tolerance, without affecting on bacterial culture results.

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